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INSTRUCTIONS FOR USING FOREST FIRE DANGER METER TYPE 8

by

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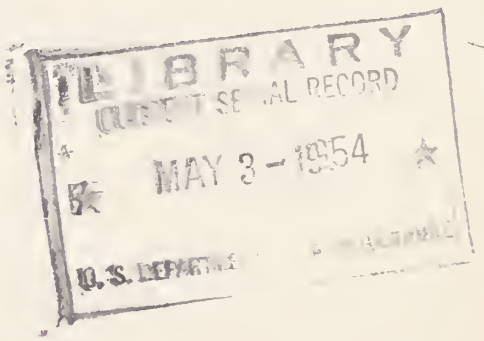

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SOUTHEASTERN FOREST EXPERIMENT STATION
Asheville, North Carolina
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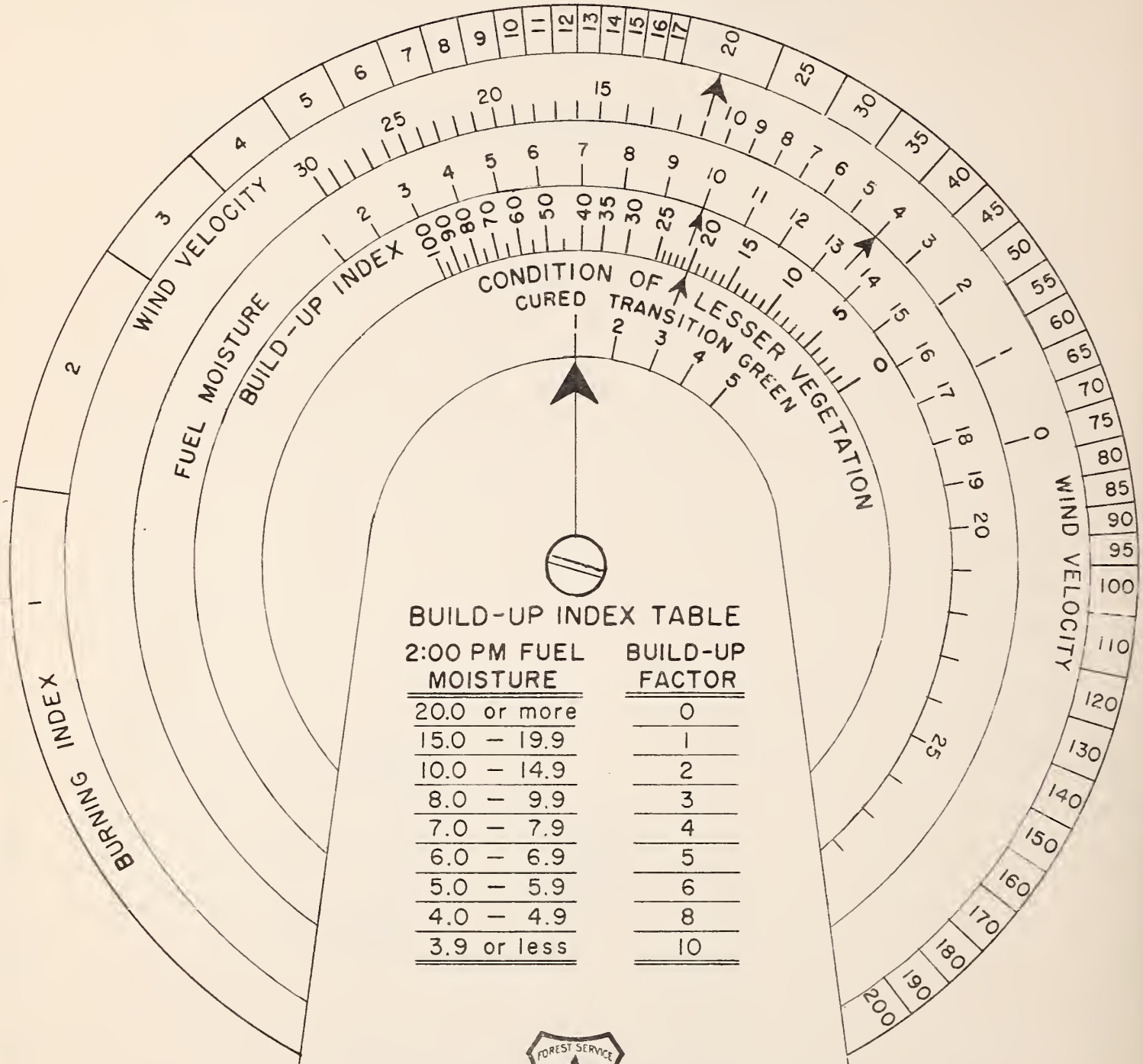
Director

FOREST FIRE DANGER METER TYPE 8-W



BUILD-UP INDEX TABLE

2:00 PM FUEL MOISTURE	BUILD-UP FACTOR
20.0 or more	0
15.0 – 19.9	1
10.0 – 14.9	2
8.0 – 9.9	3
7.0 – 7.9	4
6.0 – 6.9	5
5.0 – 5.9	6
4.0 – 4.9	8
3.9 or less	10

FOREST SERVICE

U. S. Department of Agriculture

Southeastern Forest Experiment Station

Asheville, North Carolina

INSTRUCTIONS FOR USING FOREST FIRE DANGER METER TYPE 8

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INTRODUCTION

The following instructions apply to meter 8-W (woods-type station), and to meter 8-0 (open-type station), issued by the Southeastern Forest Experiment Station. These meters replace types 5-W and 5-0, in U. S. Forest Service Region 7 territory, effective January 1954. The shift in fire danger meters has been approved by the Regional Forester for use on national forests, and by the State Foresters at their June 1953 meeting in Philadelphia.

The changes incorporated in meter 8 were suggested by experienced fire control officers throughout the region who wanted a more consistent meter, particularly with respect to the fire danger build-up during drought periods. Also, a meter was wanted that did not overrate periods of sub-normal fire danger when days are relatively cool and intermittent light showers occur. Briefly, meter 8 retains the same basic factors as meter 5, but differs in three respects: (1) a "Build-up Index" disc replaces the discs on the type 5 meters representing season of the year, last rain in inches, and days since rain; (2) condition of vegetation has 5 settings instead of the former 3; and (3) the burning index scale, which is identical with the type 5 meters from 1 to 100, has been extended to 200. The extension was made so that stations in a district network having readings above 100 could be more accurately averaged when computing the district burning index.

During periods of "normal" fire danger, meter 8 will give approximately the same burning index as the type 5 meters. During easy fire weather, the daily burning index will be lower. When extended droughts occur, or shorter periods of hot, dry weather, the burning index will usually be higher--up to 150 percent of meter 5.

Because of these changes in the fire danger factors, the instructions discussed in this paper and the revised form for recording daily fire danger must be used with meter 8. There has been no change in the standards for selecting danger station sites, or for installing and maintaining the fire danger equipment. These standards, and the procedures to be followed in taking the measurements of wind velocity, fuel moisture, and rain, are described in USDA Handbook No. 1 and Southeastern Station Technical Note No. 71.

1/ Forester (Fire Control), USDA, Forest Service, Region 7, Division of State and Private Forestry.

Form 14-R-7 (Rev. Jan. 1954) FIRE DANGER DAILY RECORD April (month) 1952

Sample (State or Forest) Sample (District) Sample (woods-type) (Station) John Doe (Observer)

Day of the Month	Condition of the Lesser Vegetation	9 A.M. EST			24 HOUR RAINFALL 2 P.M. TO 2 P.M. (Hundredths)			2 P.M. EST					5 P.M. EST			Highest Burning Index for the Day
		Fuel Moisture Percent	Wind Velocity Miles per Hour	Burning Index	Amount of Rain Danger Station	Amount of Rain Coop. Station	Average Amount of Rainfall	Build-up Index March 31 = 36	Build-up Factor	Fuel Moisture Percent	Wind Velocity Miles per Hour	Burning Index	Fuel Moisture Percent	Wind Velocity Miles per Hour	Burning Index	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	50+	2.0	1	9	10	10	29	3	9.3	3.0	25	9.0	3.5	30	30
2	1	50+	3.0	1	13	25	19	15	5	6.0	5.0	35	5.3	4.5	35	35
3	1	11.0	2.5	10			0	23	8	4.0	6.0	65	3.6	4.5	60	65
4	1	8.8	0	11			0	29	6	5.0	3.0	50	5.0	5.0	60	60
5	1	50+	0	1	85	45	65	2	2	11.8	7.0	8	10.2	5.5	9	9
6	1	11.7	6.0	7			0	5	3	8.0	8.0	20	8.2	6.5	20	20
7	1	10.0	2.5	7			0	13	8	4.0	4.0	40	4.0	2.0	30	40
8	1	12.2	0	4	T	T	0	18	5	6.0	2.0	25	5.6	3.0	35	35
9	1	13.0	1.5	6			0	26	8	4.8	4.0	55	4.3	3.0	50	55
10	1	14.2	0	4			0	34	8	4.1	3.5	65	4.5	3.0	60	65
11	1	10.0	3.0	25			0	44	10	3.5	3.5	80	3.8	2.5	70	80
12	1	9.7	1.5	25			0	50	6	5.0	2.5	65	4.9	2.0	60	65
13	1	16.2	2.0	9	10	10	10	40	0	50+	3.0	1	50+	2.0	1	9
14	1	50+	0	1	40	48	44	0	0	22.0	2.0	1	20.0	4.0	1	1
15	2	17.5	3.5	2			0	2	2	11.0	4.0	5	10.9	5.5	6	6
16	2	16.0	0	1	0	T	0	8	6	5.3	3.5	20	4.5	3.0	20	20
17	2	10.2	3.5	7			0	18	10	3.5	4.0	40	3.0	2.5	35	40
18	2	9.1	1.5	10			0	28	10	3.4	3.0	50	3.1	1.5	40	50
19	2	8.2	0	11			0	38	10	3.1	3.5	65	3.0	2.0	55	65
20	2	6.8	0	20			0	48	10	2.7	4.0	80	3.1	3.0	70	80
21	2	6.9	0	20			0	58	10	3.2	3.0	75	3.5	1.5	60	75
22	2	8.5	0	20			0	68	10	2.8	5.0	100	2.7	5.5	100	100
23	2	7.4	0	25			0	78	10	3.5	6.5	110	4.0	4.5	90	110
24	2	50+	0	1	152	150	151	0	0	50+	3.0	1	50+	0	1	1
25	3	50+	0	1	78	80	79	0	0	50+	0	1	50+	0	1	1
26	3	50+	0	1	14	11	12	0	0	50+	0	1	50+	0	1	1
27	3	50+	0	1	30	65	48	0	0	50+	2.0	1	50+	4.0	1	1
28	3	50+	0	1	30	40	35	0	0	45.0	3.5	1	29.0	2.0	1	1
29	3	15.2	2.0	1			0	3	3	8.1	4.0	6	7.9	2.5	5	6
30	3	13.0	2.5	2			0	11	8	4.3	3.5	20	3.9	3.0	20	20
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INSTRUCTIONS FOR RECORDING FIRE DANGER FACTORS AND PREPARING FIRE DANGER DAILY RECORD (Form 14-R-7, Rev. Jan. 1954)

GENERAL: The procedures discussed below are illustrated on the opposite page in the sample Fire Danger Daily Record, which is based on a report from a typical woods-type station, using meter 8-W. The report for open-type stations, using meter 8-O, is prepared in the same way.

Fuel Moisture Percent--columns 3, 11, and 14: Fuel moisture measurements should be recorded to the nearest one-tenth percent up to 20 percent; to nearest one-half percent above 20 percent. Example: nine and three-tenths percent should be recorded 9.3. If snow covers the ground in the woods at observation time (regardless of whether or not there is snow on the sticks), do not read the sticks. The letter S (for snow) should be recorded in the fuel moisture columns until the snow becomes patchy on the south slopes in the woods. Then resume reading the sticks.

Wind Velocity Miles Per Hour--columns 4, 12, and 15: Wind velocity measurements should be recorded to the nearest one-half mile, according to the wind correction table posted in the weighing shelter. Example: three and one-half miles per hour should be recorded 3.5. If anemometer cups do not turn during a 4-minute period at observation time, enter 0 (zero) in the wind velocity column. There is no need to read the wind when snow blankets the ground in the woods, because the burning index is automatically zero. A dash should therefore be recorded in the wind velocity column whenever the letter S (for snow) is recorded in the adjacent fuel moisture column.

24-Hour Rainfall--columns 6, 7, and 8: The amount of rain that has collected in your rain gage (since 2 p.m. yesterday) should be recorded in column 6, and the amount reported from a cooperating observer (if there is one) in column 7. Compute the average rainfall by adding the amounts in columns 6 and 7, divide by 2, and enter the average in column 8. When there is rain at your station, but no report is received from the cooperating station, enter a dash in column 7, and repeat your entry in column 8. When no rain occurs, zero should be recorded in column 8.

> NOTE that the rainfall amounts in columns 6, 7, and 8 should be recorded in whole units (without the decimal point). For example, one hundredth of an inch (.01") should be recorded as 1; 50 hundredths of an inch (.50") as 50; and 1 inch and 25 hundredths (1.25") as 125. If rainfall is less than one hundredth (.01"), enter "T" for trace.

Condition of the Lesser Vegetation--column 2: Record numeral 1, 2, 3, 4, or 5 as advised by your district forester or ranger. Do not attempt to make a classification change without the approval of the district officer in charge. The figure to use must be based on the estimated condition of the lesser vegetation, such as grasses, weeds, ferns, and shrubs in natural areas, regardless of whether your station is the open or woods type. It is emphasized that the amount or size of tree foliage, whether the hardwood trees are in full leaf or leafless, is not used as a criterion in estimating the condition of the lesser vegetation.

The following guide lines will be helpful in selecting the proper condition to record in column 2:

Use number 1 when the lesser vegetation is 90 percent or more cured. This is the normal winter condition that will usually prevail throughout most of the Northeast during the 5-1/2 month period from November 1 to April 15.

Use number 5 when the lesser vegetation is 90 percent or more green. This is the normal summer condition that will usually prevail throughout most of the Northeast during the 4-1/2 month period from May 15 to September 30.

Use number 2, 3, or 4 when the lesser vegetation is in the transition stage, neither fully cured nor green. In normal seasons these transition stages will usually prevail for periods of approximately 10 days each, from April 15-May 15 and from October 1-31. However, there is no assurance that any month in the year will be "normal," so watch out for the effects of unusual weather conditions.

In the spring, condition 2 may occur in late March in some years if a series of unseasonably warm days revives the lesser vegetation. Or the season may advance rapidly so that conditions 2, 3, and 4 apply only for short periods of less than a week each. A late spring freeze may set the conditions back from 4 to 3 or from 3 to 2.

In the summer, the thing to watch for in the normal green season is the effect of drought periods that will start curing of the lesser vegetation. Strict rules will not apply in every instance, but the Build-up Index may help in judging the condition. Vegetation condition 4 should be checked when Build-up Index reaches 40, condition 3 should be checked at 75, and condition 2 at 100. The lesser vegetation will very rarely proceed to condition 1 in the summer season. If adequate rains revive the lesser vegetation, the condition should be shifted back to 5 when warranted.

In the fall, with normal distribution of rainfall, the vegetation condition will usually remain in condition 5 until the first killing frost. If 50 percent of the vegetation is immediately killed, the shift would be made to condition 3, by-passing condition 4. A succession of hard freezes might produce condition 2 in a few days.

> NOTE: The decision to change screens at open-type danger stations should not be confused with the condition of the lesser vegetation. The screens are shifted in relation to the amount of tree foliage, as described on pages 8 and 10, Technical Note 71, issued by the Southeastern Station.

Build-up Factor--column 10: The Build-up Factor is based on the 2 p.m. fuel moisture reading (column 11). Refer to the table on the central tab of the danger meter for the proper Build-up Factor, according to the measured fuel moisture. For example: if 2 p.m. fuel moisture is 6.2, enter 5 in column 10; if 2 p.m. fuel moisture is 28.5, enter 0 (zero) in column 10.

Build-up Index--column 9: This is the setting used on the danger meter in place of days since rain (type 5 meters). You will note that the Build-up Index disc is calibrated from 0 to 100. Therefore, do not enter in column 9 any values less than 0, nor more than 100. The Build-up Index is computed from data recorded in column 8 (rainfall) and column 10 (Build-up Factor). The procedure is simple: subtract the rain from the previous day's Build-up Index first, then add the Build-up Factor to obtain the new Build-up Index. In the absence of rain, simply add the Build-up Factor in column 10 to the previous day's Build-up Index. For example: Build-up Index yesterday was 20, rain 10 hundredths last night, and Build-up Factor today is 5. Today's Build-up Index would be computed as follows: 20 less 10 equals 10, plus 5 equals 15.

> NOTE: The Build-up Index in column 9 is the meter setting used to derive both the 2 p.m. and 5 p.m. burning index of that day. The 9 a.m. burning index, or a recording at any other morning hour, should be based on the Build-up Index of the previous day.
>
> For continuity of record, it is desirable when starting a new month to enter the status of the Build-up Index on the last day of the preceding month at the top of column 9.

Part Time Stations: Danger stations that operate only during the fire season, usually for a 2-month period in spring and fall, will have to estimate a Build-up Index in order to get started. If a

year-long key station is operating on the district, use the Build-up Index reported from the key station as a starting point, and thereafter proceed on your own measurements. If there is no key station operating, an estimate of the Build-up Index should be made on a basis of elapsed time since rain. Count back the days to the last rain of 50 or more (1/2 inch or more) and multiply the number of days by 3. For example, 6 days times 3 equals 18--the estimated Build-up Index on your opening day.

BUILD-UP INDEX AS A GUIDE TO WOODS CLOSURES

The fuel moisture sticks indicate the moisture condition of the surface layer of litter. The Build-up Index reflects the cumulative build-up of inflammable conditions in the litter below the surface layer. Hence, fires that occur when the Build-up Index is high and when lower fuels are drying out, are likely to be deeper-burning fires that will be harder to control and will require more mop-up and patrol. Since the Build-up Index will be computed daily at each danger station, the trend toward a potentially dangerous fire situation can be recognized in advance from these daily reports.

There is no single critical point on the Build-up Index scale, but values above 30 should be viewed as a warning signal that a build-up above normal is developing. To illustrate, on an annual basis, from records for the 3-year period 1950-52, less than 10 percent of the days on the Monongahela National Forest were above 30. On the other end of the scale, a Build-up Index of 80 is definitely in the danger zone. New England forests are usually closed well in advance of the 80 point. For example, the 6 closures effected in Rhode Island, 1950-52, averaged a Build-up Index of 52. Consequently, a Build-up Index range of 30 to 60 is recommended at present as a guide to the State Foresters in requesting woods closures from their governors. Closures in the lower section of this range (30 to 40) will probably be needed only when unusually high winds have prevailed, or are predicted, or when an exceptional risk is expected, such as the opening of hunting season.

In areas where a full closure calling for a governor's proclamation does not seem warranted, or in units where closure laws are not in effect, the Build-up Index should be a useful guide in stepping up prevention efforts to alert the public as the build-up progresses.

In application, the Build-up Index should be computed by districts or closure zones, as was done with the cumulative danger index, by computing an arithmetic average of the daily Build-up Index reports from the danger stations representing the unit. The Build-up Index is simpler and more accurate than the cumulative danger index; hence, the

special computations involving the use of normals and adjustments for precipitation may be discontinued.

There will perhaps be some question as to how widely the type 8 meter can be applied outside of Region 7. According to the Division of Fire Research at the Southeastern Forest Experiment Station, Asheville, N. C., preliminary tests made by them indicate that type 8 meter can be used with satisfactory results for the mountainous areas of Region 8. Whether it will apply equally well elsewhere remains to be determined.